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ABSTRACT

This training document outlines the apprenticeship training standards for the trade of patternmaker that have been approved by the Ontario Ministry of Skills Development. The document consists of the following: (1) skills (competencies) identified by a trade analysis development group of practicing patternmakers; (2) general performance objectives that summarize the related skills of a trade cluster in behavioral terms and that state the conditions and required performance criteria; and (3) specific performance objectives that describe the individual trade skills and that state detailed conditions and required performance criteria. Standards are provided for training units on the following: protecting oneself and others; planning and organizing the production of models, patterns, and coreboxes; creating master patterns, coreboxes, and coresticks; creating master models; producing plastic molds from a master pattern or model, working plastic foundry patterns from a master mold, master coreboxes from a corestick, a working integrally cast match plat or cope and drag set, a working split-mounted foundry pattern, and a fully machined metal corebox; and checking designs and using construction fixtures and gauges. A Developing a Curriculum (DACUM) competency chart is appended. (MN)

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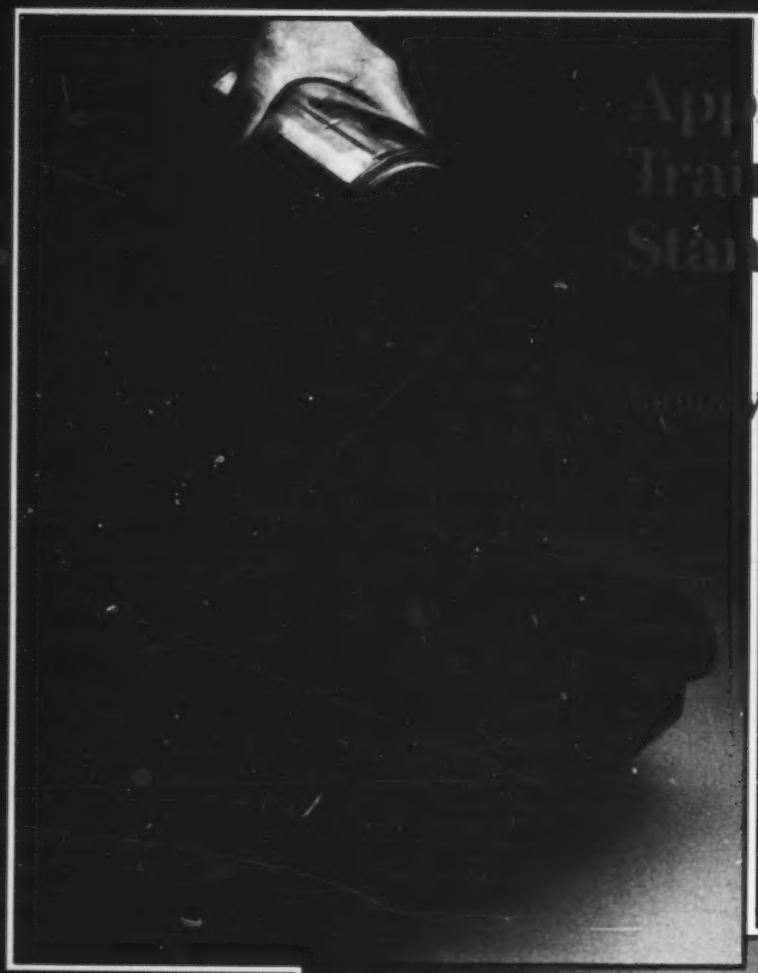
Apprenticeship Training Standards



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Apprenticeship Training Standards

Ministry of Skills Development

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PREFACE

This training document is published by the Apprenticeship Branch of the Ministry of Skills Development to define the approved provincial apprenticeship training standards for the trade of patternmaker.

Development work in this apprenticeship program was completed with the assistance of industry representatives.

The standards contained in this publication are expressed as performance objectives which describe the intended outcomes of classroom training and on-the-job instruction rather than theoretical knowledge and school curriculum.

The objectives described here provide a basis for the in-school training of apprentices and a definitive guide to employers, trainers and apprentices during the on-the-job portion of training.

Employers are expected to reinforce the in-school training with practical training and work experience in the patternmaking shop. This will enable the apprentice to achieve the minimum acceptable performance standards identified by the industry for practitioners in this trade prior to certification.

INTRODUCTION

This training standards document consists of:

- skills (competencies) identified by a trade analysis development group of practising patternmakers.
- general performance objectives which summarize the related skills of a trade cluster in behavioral terms and states the conditions and required performance criteria.
- specific performance objectives which describe the individual trade skills and state the detailed conditions and required performance criteria.

The skills and the corresponding performance objectives carry the same number for identification and cross-reference purposes.

1. PROTECT SELF AND OTHERS

GENERAL PERFORMANCE OBJECTIVE

Wear, adjust and maintain safety clothing and equipment and protect self and others by carefully handling hazardous material; practising personal hygiene; reporting all hazards; removing obstacles and impediments; carefully operating lifting devices and safely rigging and securing loads in accordance with established safety procedures and legislation.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

1.1 Wear, adjust and maintain eye protectors to ensure optimum protection and correct fit.

1.2 Wear, adjust and maintain foot protectors to ensure correct fit, provide optimum protection and in compliance with the Ontario Occupational Health and Safety Act.

1.3 Wear and adjust ear protectors to ensure correct fit and provide optimum protection.

1.4 Wear, adjust and maintain protective clothing to ensure optimum protection and correct fit.

1.5 Wear and maintain hand protectors to ensure correct fit and optimum protection.

1.6 Practise personal hygiene in the workplace by washing and showering to avoid contamination, wearing proper clothing and using barrier creams to prevent the absorption or intrusion of chemicals into the body.

1.7 Deal with real or potentially hazardous conditions in the workplace by following company procedures.

1.8 Identify site-specific audible and visual alarms.

1.9 Follow company fire procedures.

1.10 Lockout and tag electrical and mechanical equipment for repair/maintenance following legal and company procedures.

1.11 Handle, transport and store hazardous material including resins, lacquers, isocyanates, thinners, methyl hydrate and acetone to ensure the safety of self and others and in compliance with the Ontario Occupational Health and Safety Act.

1.12 Practice good housekeeping by maintaining a safe, tidy work environment and by removing all obstacles and impediments.

1.13 Follow reporting procedures so that hazards are promptly and efficiently identified and the potential for accidents and injury is minimized.

1.14 Operate lifting devices including: hoists, block and tackle, lift trucks and overhead cranes safely and in compliance with legal and company standards and regulations.

1.15 Rig and secure loads according to company procedures and safety precautions to be observed.

2. PLAN OUT AND ORGANIZE THE PRODUCTION OF MODELS, PATTERNS AND COREBOXES

GENERAL PERFORMANCE OBJECTIVE

Plan out and organize the production of models, patterns and coreboxes by reading and interpreting engineering drawings; producing layouts of sections and/or plans; designing and producing templates; and determining construction procedures so that the equipment produced meets customers' requirements and matches drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

2.1 Read and interpret engineering drawings for the component or part, including blueprints and mylars, to indentify actual dimensions and dimensional tolerances, the machine surface designation and allowances, the material from which the component will be produced and its degree of contraction.

2.2 Visualize the three-dimensional object to be produced from a sketch, blueprint or mylar to identify coreprints and loose pieces and locate taper and parting lines.

2.3 Assess accuracy of engineering drawings to identify all errors, anomalies or omissions that would require clarification from the customer prior to production of a model, pattern or corebox.

2.4 Sectionalize the engineering drawing, identifying all construction joints in order to facilitate the manufacture of the pattern, corebox or model.

2.5 Determine types, shapes and sizes of cores to produce a casting with dimensions in accordance with engineering drawing specifications.

2.6 Determine the gating and runner system that will produce a casting according to drawing specifications and to the customer's/foundry's equipment and processes.

2.7 Calculate correct shrinkage/contraction allowances using a calculator according to customer's or foundry's specification for degree of shrinkage.

2.8 Perform geometric and trigonometric calculations to lay out angles accurately.

2.9 Convert drawing dimensions from SI to Imperial, Imperial to SI and from fractions to decimals so that patterns, models and coreboxes can be produced with available tools, shop equipment and measuring devices.

2.10 Confer with supervisor to confirm drawing interpretation is complete, accurate and in accordance with job requirements.

2.11 Produce full-scale layout(s) of sections and/or plans with a scriber upon a flat rigid material including construction details, draft angles, machining and contraction allowances and accepted foundry practices for cores, coreprints and loose pieces, to drawing specifications.

2.12 Design and produce template(s) for use in checking and creating the contour of patterns, coreboxes and models that conform to the layout, from smooth faced, thin, flat and rigid material.

2.13 Determine construction procedures for patterns, coreboxes or models identifying available material, type of pattern, machine capacity, run length of working pattern and methods and sequence of operations so that the dimensional accuracy is maintained, shrinkage is minimized and strength is maximized.

3. CREATE A MASTER PATTERN, COREBOX, AND/OR CORESTICK

GENERAL PERFORMANCE OBJECTIVE

Create a master pattern, corebox and/or corestick in wood or solid plastic by selecting, sizing, and gluing up the material; surfacing the top, bottom, and one end and one side; laying out, shaping, finishing, and adapting the master pattern equipment so that it is mouldable and in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

3.1 Select wood for master pattern, corebox, and/or corestick of a type specified by the customer that is dry, has a straight grain with no shakes or checks and only small blemishes.

3.2 Size rough wood using a cut-off saw, planer and/or joiner according to size and shape of layout.

3.3 Glue up wood for basic sections using polyvinyl white glue or resin, fasteners and clamps so that grain is reversed to reduce potential for warpage and block and is slightly oversized when compared to layout.

3.4 Surface top, bottom, one end and one side of material to establish x,y,z co-ordinates with planer, sander, and milling machines so faces are parallel and square and the number of repeat operations is limited.

3.5 Lay out material using appropriate shrink rule, height gauge, scriber, marking gauge, square, dividers, verniers and trammels to enable the cutting away of surplus, the shaping of the master and the addition of ancillary parts in accordance with construction plan and to drawing specifications.

3.6 Cut material to basic shape using hand tools, power tools, sanders, milling machines and lathes in accordance with drawing specifications and finish allowance.

3.7 Assemble fabricated sections as per construction plan, with glue, and fasteners to drawing specifications.

3.8 Conduct dimensional check of the master pattern, corebox or corestick using micrometers, verniers and height gauges so master matches drawing specifications.

3.9 Radius outside corners using hand tools or sandpaper and apply fillets to inside corners using leather, polyester filler, or plastic strips and check using radius gauges so dimensions match drawing specifications.

3.10 Prepare surfaces and cavities of patterns, coreboxes and coresticks by filling blemishes, holes and cracks and sandpapering so that the finish is acceptable to customer/management and so that master pattern equipment is mouldable.

3.11 Apply surface coatings including lacquers, sanding sealer, polyurethane and epoxy by brushing or spraying so that coatings are flexible, smooth, moisture, wear and abrasion resistant, do not react with moulding material, strongly adhere to surface and are according to American standard colour code.

3.12 Adapt master pattern or corebox for the moulding and/or core process by adding wrapping or drawing plates to pattern and by mounting on cope and drag or follow boards and by adding handles or trunions to coreboxes so that a satisfactory casting can be produced and to facilitate the removal of pattern or corebox from the moulding medium.

4. CREATE A MASTER MODEL

GENERAL PERFORMANCE OBJECTIVE

Create a master model in a stable, easily machinable material for stamping dies, plastic moulds or metal castings by selecting, sizing and gluing up the material, surfacing the top, bottom, one end and one side; laying out, cutting and assembling sections; marking and preparing joint lines, trim lines, taper, and tooling holes and finishing surfaces so that model is mouldable and in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

4.1 Select material for a master model that is cured, with a straight grain, with no shakes or checks, only small blemishes and of the type specified by the customer.

4.2 Size rough material using a cut-off saw, planer and/or joiner according to size and shape of layout.

4.3 Glue up material for basic sections using polyvinyl white glue or resin and clamps so that potential warpage or shrinkage is reduced and block of material is slightly oversized when compared to layout.

4.4 Surface top, bottom, one end and one side of material to establish x,y,z co-ordinates with planer, sander, and milling machines so faces are parallel and square and the number of repeat operations are limited.

4.5 Lay out material using appropriate shrink rules, height gauges, scriber, marking gauge, square, dividers, verniers and trammels to enable the cutting away of surplus, the shaping of the model and the addition of ancillary parts in accordance with construction plan and to drawing specifications.

4.6 Cut material to basic shape using hand tools, power tools, sanders, milling machines and lathes, in accordance with drawing specifications and finish allowance.

4.7 Assemble fabricated sections as per construction plan, with glue, to drawing specification.

4.8 Prepare joint lines for moulding from a suitable material, so that finished part can be extracted from mould within tolerance.

4.9 Mark trim lines on model for stamping using a vernier according to drawing specifications.

4.10 Put taper on master model surfaces so that it is mouldable and can be extracted from mould.

4.11 Mark out all tooling holes and add bushings required by customer for job and part alignment according to drawing specifications.

4.12 Prepare matching joints of a core drawback so mating surfaces are aligned and drawback moves freely.

4.13 Mark tolerance on the trim line of model according to customer requirements or tolerances identified on drawing.

4.14 Radius outside corners using hand tools or sandpaper and apply wax fillets to inside corners and check with radius gauge so dimensions match drawing specifications.

4.15 Prepare surfaces of master model by filling blemishes, holes and cracks and sandpapering so that finish is acceptable to customer and model is mouldable.

4.16 Apply surface coating of sanding sealer to model using brush or spray so that all pores of grain are filled and coat is smooth and even.

4.17 Mark holes and surplus material with black paint using brush or spray so that markings are precise and according to drawing specifications.

5. PRODUCE A PLASTIC MOULD FROM A MASTER PATTERN OR MODEL

GENERAL PERFORMANCE OBJECTIVE

Produce a plastic mould from a master pattern or model by building a support frame, fabricating fillblocks or reinforcing core, applying surface coatings, selecting, weighing and mixing resins and catalysts, applying casting resin, reinforcing material or bulk filler to model or pattern, extracting pattern or model and inspecting mould surface so that plastic mould produced will create a working pattern in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

5.1 Select plastic mould production method: either hand lay up, backfiller or casting resin depending on the size or mass of the mould, the accuracy, durability and abrasion resistance required, the cost and job/customer requirements.

5.2 Build support frame/container/dam to form outside of mould and coat with release agent so that device is manufactured from inexpensive material, is leak resistant, of required size and with sides that are smooth and flat.

5.3 Fabricate fill block for casting resin process and fasten into place to allow for equal material of even thickness all around master pattern/model.

5.4 Fabricate reinforcing core with suitable clearances for hand lay up and attach metal hardware for bolting and dowelling at predetermined positions so that core reinforcing is above joint surface to allow for machining later, and so that metal hardware is permanently positioned and suitable for drilling and tapping.

5.5 Apply surface coating to master pattern/model, including sanding sealer, and wax with release agent using spray or brush so that resin and reinforcing material will not stick to master and surface coat is smooth and even.

5.6 Select resins, matching catalyst and associated ratio of components according to job requirements regarding economy, dimensional stability, mass, heat, permanency and wearability.

5.7 Weigh the resin and catalyst separately and then mix mechanically or by hand so that colour is consistent with no streaks, ensuring that no soft spots develop in mould and instructions are followed as per packaging or fact sheet.

5.8 Pour casting resin into cavity slowly and steadily with no aspiration ensuring that air in mould is vented, casting resin is at a suitable hydrostatic pressure to produce a mould with no holes or imperfections and plastic comes above joint surface.

5.9 Hand lay up reinforcing material to surface coat and insert reinforcing core so that each layer of reinforcement is fully wetted with resin and is in full contact with and overlaps joints in the previous layer and so that the mould produced retains the original form of the master pattern/model and is durable, stable, and fully cured and of a predetermined thickness.

5.10 Apply stabilized bulk filler to surface coat so that the surface of master pattern is completely covered and the mould produced is strong, stable and fully cured.

5.11 Remove excess material from the joint face using a milling machine so that joint surface is smooth, flat and to dimension.

5.12 Extract master pattern/model from plastic mould so that the mould is not distorted and the pattern/model is not damaged.

5.13 Inspect mould surface finish for defects and repair with wax, plasticene or filler so that surface is smooth with no shrinks or holes and to specified dimensions.

6. PRODUCE A WORKING PLASTIC FOUNDRY PATTERN FROM A MASTER MOULD

GENERAL PERFORMANCE OBJECTIVE

Produce a working plastic foundry pattern from a master mould by building a support frame; fabricating fillblocks, back-ups or reinforcing cores; applying mould release; selecting, weighing and mixing resins and catalysts; applying casting resin or reinforcing material to master mould; removing excess material from pattern; extracting mould from pattern and inspecting pattern surface so that the working plastic pattern produced will be in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

6.1 Check surface finish of master mould for defects so that the surface is smooth, with no shrinks or holes and to specified dimensions.

6.2 Select plastic working pattern production method, either hand lay up or casting resin, depending on the size or mass of the pattern, the accuracy, durability and abrasion resistance required, the cost and job/customer requirements.

6.3 Build support frame/container/dam to form outside of pattern and coat with release agent so that device is manufactured from inexpensive material, is leak resistant, of required size and with sides that are smooth and flat.

6.4 Fabricate fill block, including metal hardware, for casting resin process and fasten into place to allow for equal material of even thickness all around master mould and to facilitate bolting and dowelling at predetermined positions.

6.5 Fabricate a master filler block in a shell configuration with ribs and bosses to facilitate dowelling and fastening so that there is an even clearance for resin flow and ribs and bosses are in predetermined positions to produce a metal casting.

6.6 Fabricate reinforcing core with suitable clearances for hand lay up and attach metal hardware for bolting and dowelling at predetermined positions so that core reinforcing is above joint surface to allow for machining later, and so that metal hardware is permanently positioned and suitable for drilling and tapping.

6.7 (For coreboxes) Create a working wooden pattern for aluminum back-up casting incorporating lugs for dowelling and adaptation and an even clearance for resin liner.

6.8 Roughen cavity area of aluminum back-up casting to ensure complete adhesion of resin, then machine face and back using a mill machine so they are parallel.

6.9 Apply mould release to master mould, using spray or brush so that resin will not stick to master mould.

6.10 Select resins, matching catalysts and associated ratio of components according to job requirements regarding economy, dimensional stability, mass, heat, permanency and wearability.

6.11 Weigh the resin and catalyst separately and then mix mechanically or by hand so that colour is consistent and has no streaks and that no soft spots develop in the working pattern or corebox and instructions are followed as per packaging or fact sheet.

6.12 Pour casting resin into the cavity slowly and steadily with no aspiration, ensuring that air is vented, casting resin is at a suitable hydrostatic pressure to produce a working pattern or corebox with no holes or imperfections and the plastic comes above joint surface.

6.13 Hand lay up reinforcing material to surface coat and insert reinforcing core so that each layer of reinforcement is fully wetted with resin and is in full contact with and overlaps joints in the previous layer and so that the pattern produced retains the original form of the master mould and is durable, stable, fully cured and of a predetermined thickness.

6.14 Remove excess material from the joint face using a milling machine so that joint surface is smooth, flat and to dimension.

6.15 Extract master mould from working plastic pattern so that the master mould is not distorted and the working pattern/corebox is not damaged.

6.16 Inspect surface finish of working pattern for defects and repair with quick-set compound so that the surface is smooth with no shrinks or holes, and the pattern is to specified dimensions and repairs are permanent.

7. PRODUCE A MASTER COREBOX FROM A CORESTICK

GENERAL PERFORMANCE OBJECTIVE

Produce a master corebox from a corestick by fabricating a support frame, lightener blocks and braces of reinforcing material; applying release agent; selecting, weighing and mixing material; applying casting or reinforcing material; extracting corestick, lightener blocks and frame from corebox and inspecting internal and external surfaces so that master corebox meets customer requirements and is in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

7.1 Select master corebox production method; either casting or hand lay up depending on the size or mass of the corebox, the accuracy, durability and abrasion resistance required, the cost and the job or customer requirements.

7.2 Produce a support frame or box to form outside of corebox so that material is leak resistant, of required size and with sides that are smooth and flat.

7.3 Fabricate lightener blocks to be suspended from the frame with a smooth/fine finish and with required draft to allow for equal material of even distribution around corestick.

7.4 Fabricate braces of reinforcing material with suitable clearances for hand lay up and so that reinforcing braces are above joint surface for machining later.

7.5 Apply release agent to corestick, lightener blocks and surfaces of frame or box where contact is made with casting resin, gypsum cement, epoxy clay and fibreglass so that corestick, lightener blocks and frame can be separated from corebox.

7.6 Select material; either casting resin, gypsum cement, epoxy clay or fibreglass resin and catalyst according to production process and to job requirements regarding economy, dimensional stability and mass.

7.7 Weigh and mix material for production of corebox using mechanical or hand mixing equipment so that colour is consistent, with no streaks, thoroughly mixed, with no lumps, and no soft spots develop in the corebox and instructions are followed as per packaging or fact sheet.

7.8 Pour casting resin or gypsum cement into frame or container slowly and steadily with no aspiration and install lightener blocks.

7.9 Hand lay up epoxy clay or fibreglass on corestick that has been covered with a gelcoat to a previously determined thickness so that corebox cavity matches corestick and install reinforcing braces.

7.10 Extract corestick, lightener blocks and frame from corebox so that neither the corebox nor the corestick is distorted or damaged.

7.11 Check interior and exterior surface finish of the master corebox and repair so that the surfaces are smooth, with no shrinks or holes, and to specified dimensions.

8. PRODUCE A WORKING INTEGRALLY CAST MATCH PLATE OR COPE AND DRAG SET

GENERAL PERFORMANCE OBJECTIVE

Produce a working integrally cast match plate or cope and drag set by inspecting, straightening, scraping and polishing the pressure casting; locating, boring and installing pins and bushings for cope and drag casting; fabricating and installing gating system(s) and installing flask slides according to customer requirements for moulding and in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

8.1 Check pressure casting visually for shrinks, cracks and blow holes to determine usability of casting.

8.2 Measure pressure casting dimensions and thickness to ensure it meets drawing specifications and customer requirements.

8.3 Straighten pressure casting plate so it is flat and parallel where it fits the flask.

8.4 (For an integrally cast cope and drag set) Machine the back face of pressure casting parallel to the parting line using a milling machine, lathe or sander to customer/management specified tolerances.

8.5 Scrape and polish pressure casting so surfaces are smooth without scratches or indentations to ensure removal of pattern from moulding medium and keeping within dimensional tolerances.

8.6 Check pressure casting for draft/taper using a square or straight edge so that the removal of the pattern from the moulding medium is facilitated and when required, scrape or fill to produce proper taper.

8.7 (For cope and drag integrally cast plates) Lay out location of pin centres and/or insert pattern perimeter and cope and drag alignment relative to drawing specifications.

8.8 (For cope and drag integrally cast plates) Bore holes for pins and bushings and/or machine perimeter of insert plates using boring machines, milling machines or radial drills according to customer specifications as to location, size and tolerance.

8.9 Install pins and bushings on cope and drag plates according to customer specifications.

8.10 Fabricate and install gating system as per foundry instructions or according to calculations made regarding ratios between down sprews, runner bars, and in-gates.

8.11 Install flask slides on integrally cast match plates so that mould pin holes and fastening holes are aligned and so that mould maintains proper alignment during moulding process.

9. PRODUCE A WORKING SPLIT MOUNTED FOUNDRY PATTERN

GENERAL PERFORMANCE OBJECTIVE

Produce a working split mounted foundry pattern by machining parting lines; dowelling patterns together; installing fastening devices; machining excess material; scraping, polishing and repairing surfaces; laying out pin centres and pattern locations; mounting patterns on moulding plates and installing gating systems(s), pins and bushings and flask slides so that pattern is mouldable, meets customer requirements and is in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

9.1 Machine parting lines/joints using milling machines, lathes or sanding discs so they are flat, smooth and to the dimensions specified on drawing.

9.2 Align and dowel cope and drag of the patterns together using a milling machine or drill press to drill and ream so that profile surfaces are flush and in a precise relationship to one another.

9.3 Intall fastening devices using a hand tap, drill press, milling machines, Allen wrenches and/or socket sets so that pattern will not separate during machining and the least possible blemish is produced on the surface of the pattern.

9.4 Machine excess material from assembled split pattern using a milling machine, lathe or hand tools so that surface is smooth and dimensions are as specified in layout/drawing.

9.5 Scrape and polish split pattern so surfaces are smooth and without scratches or indentations in accordance with drawing specifications.

9.6 Repair split mounted pattern by filling indentations and finishing to the dimensions specified on drawing.

9.7 Lay out pin centres and pattern locations on the moulding plate according to customer requirements: i.e., equipment, process and gating.

9.8 (For split mounted cope and drag patterns) Position appropriate half of pattern on moulding plate, clamp and drill through dowel locations, pin centres and fastening holes using drill press or milling machine ensuring that plate and pattern do not move, holes are straight and correct in size and are located according to drawing specifications.

9.9 (For split mounted cope and drag patterns) Align cope and drag plates with clamps or temporary dowel pins so that plates are flush and will not move.

9.10 Mount split patterns on moulding plate(s) using screws, dowels, washers and locktite, wrenches and socket sets according to customer requirements and so pattern will not separate during moulding process.

9.11 Install gating systems according to customer specifications and requirements, so gating includes all necessary sprews, in-gates, runners, and risers and molten metal will flow and produce casting to specifications.

9.12 Install pins and bushings in split mounted cope and drag patterns according to customer specifications and to ensure alignment of cope and drag.

9.13 Install flask slides on split mounted match plates so that mould pin holes and fastening holes are aligned and so that mould maintains proper alignment during the moulding process.

10. PRODUCE A METAL COREBOX: CAST TO SIZE OR CAST TO SIZE PARTIALLY MACHINED

GENERAL PERFORMANCE OBJECTIVE

Produce metal coreboxes: cast to size or cast to size partially machined, by machining back face and parting lines of casting; aligning and dowelling both halves of corebox; machining open ends and critical areas of the cavity; finishing and polishing surfaces and adapting to production requirements so that cores produced meet customer requirements, i.e. processes or equipment and are in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

10.1 Check corebox casting for defects: scratches, cracks, porosity shrinks, blow holes, scabs and dimensional accuracy, including machining allowance in accordance with drawing specifications.

10.2 Machine back face and parting lines/joints of corebox to dimensions as provided by customer using milling machines, lathes, and duplicating machines so that back is parallel to joint and relative to cavity and that cavity's dimensions are consistent with drawing.

10.3 Align and dowel both halves of metal corebox using special patented corebox dowels and drill press or lathe so both halves will separate and close without binding and so that cavity is aligned.

10.4 Machine open ends of corebox and critical areas of the cavity using milling machines, lathes or duplicating machines so surfaces are smooth and in accordance with drawing specifications and tolerances and meet customer requirements.

10.5 Finish by hand or machine and polish corebox using milling machines, lathes and hand tools so surfaces are smooth, with no imperfections or indentations, and in accordance with drawing specifications.

10.6 Adapt corebox to foundry production requirements and type of core machinery with flanges, mounting plates, and ejection system using fasteners so that the corebox fits the machines and produces a core meeting customer specifications.

11. PRODUCE A FULLY-MACHINED METAL COREBOX

GENERAL PERFORMANCE OBJECTIVE

Produce a fully-machined metal corebox by inspecting corebox castings for defects, machining back face, edge and end; laying out tooling pin centres; machining core areas; finishing and polishing surfaces and by aligning dowelling and adapting the corebox so that cores produced meet customer requirements and are in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

11.1 Check corebox castings for defects such as cracks, porosity, shrinks, blow holes, scabs and ensure that it is dimensionally of a size to be machined to drawing specifications.

11.2 Machine back face, edge and end (x,y,z axes) for locating datum points so that casting is square in all axes.

11.3 Lay out casting and model for tooling pin centres using vernier or digital height gauge so that model and casting centres correlate.

11.4 Machine core areas of corebox casting to match the physical or computer model using CAD/CAM and/or duplicating machines so that core area meets drawing specifications.

11.5 Finish by hand or machine and polish corebox using milling machines, lathes and/or handtools so surfaces are smooth, with no imperfections or indentations and in accordance with drawing specifications.

11.6 Align and dowel both halves of metal corebox using special patented corebox dowels and drill presses or lathes so both halves will separate and close without binding and cavity is aligned.

11.7 Adapt corebox to foundry production requirements and type of core machinery with flanges, mounting plates and ejection systems using fasteners so that the corebox fits the core machines and produces a core meeting customer specifications.

12. DESIGN CHECKING AND CONSTRUCTION FIXTURES AND GAUGES

GENERAL PERFORMANCE OBJECTIVE

Design checking and construction fixtures and gauges including core checking devices, core assembly fixtures, core setting/checking gauges, component checkers, machining and construction fixtures from wood, plastic or metal in accordance with drawing specifications.

SKILLS SPECIFIC PERFORMANCE OBJECTIVES

12.1 Fabricate core checking devices of metal or wood which correctly locate and size cores in accordance with drawing specifications.

12.2 Fabricate a core assembly fixture from metal, plastic or wood that locates several cores so they function as a single unit in accordance with drawing specifications.

12.3 Fabricate core setting/checking gauges that use the mould or pin centres for locating cores in moulds in accordance with drawing specifications.

12.4 Produce component checkers that can be used to inspect castings or stamped parts at critical points in accordance with drawing specifications.

12.5 Produce machinery aids, including jigs, fixtures and assembly blocks, to hold, locate and finally secure components in machine tools.

12.6 Fabricate construction fixtures out of wood to build core sticks, core blocks, and patterns in accordance with drawing specifications.

DACUM/COMPETENCY CHART
PATTERNMAKER

AREAS OF COMPETENCY

◄ SKILLS ►

PROTECT SELF AND OTHERS 1.0	WEAR, ADJUST AND MAINTAIN EYE PROTECTORS 1.1	WEAR, ADJUST AND MAINTAIN FOOT PROTECTORS 1.2	WEAR AND ADJUST EAR PROTECTORS 1.3	WEAR, ADJUST AND MAINTAIN PROTECTIVE CLOTHING 1.4	WEAR AND MAINTAIN HAND PROTECTORS 1.5	PRACTICE PERSONAL HYGIENE 1.6	DEAL WITH ACTUAL OR POTENTIALLY HAZARDOUS CONDITIONS 1.7	IDENTIFY SITE-SPECIFIC AUDIBLE AND VISUAL ALARMS 1.8
PLAN OUT AND ORGANIZE THE PRODUCTION OF MODELS PATTERNS AND CORE BOXES 2.0	READ AND INTERPRET ENGINEERING DRAWINGS 2.1	VISUALIZE THE THREE-DIMENSIONAL OBJECT TO BE PRODUCED 2.2	ASSESS ACCURACY OF ENGINEERING DRAWINGS 2.3	SECTIONALIZE THE ENGINEERING DRAWING 2.4	DETERMINE TYPES SHAPES AND SIZES OF CORES 2.5	DETERMINE THE GATING AND RUNNER SYSTEM 2.6	CALCULATE CORRECT SHRINKAGE/ CONTRACTION ALLOWANCES 2.7	PERFORM GEOMETRIC AND TRIGONOMETRIC CALCULATIONS 2.8
CREATE A MASTER PATTERN, COREBOX AND/OR CORESTICK 3.0	SELECT WOOD 3.1	SIZE ROUGH WOOD 3.2	GLUE-UP WOOD FOR BASIC SECTIONS 3.3	SURFACE TOP, BOTTOM, ONE END AND ONE SIDE OF MATERIAL 3.4	LAY OUT MATERIAL 3.5	CUT MATERIAL TO BASIC SHAPE 3.6	ASSEMBLE FABRICATED SECTIONS 3.7	CONDUCT DIMENSIONAL CHECK 3.8
CREATE A MASTER MODEL 4.0	SELECT MATERIAL 4.1	SIZE ROUGH MATERIAL 4.2	GLUE-UP MATERIAL FOR BASIC SECTIONS 4.3	SURFACE TOP BOTTOM, ONE END AND ONE SIDE OF MATERIAL 4.4	LAY OUT MATERIAL 4.5	CUT MATERIAL TO BASIC SHAPE 4.6	ASSEMBLE FABRICATED SECTIONS 4.7	PREPARE JOINT LINES FOR MOULDING 4.8
PRODUCE A PLASTIC MOULD FROM A MASTER PATTERN OR MODEL 5.0	SELECT PLASTIC MOULD PRODUCTION METHOD 5.1	BUILD SUPPORT FRAME AND COAT WITH RELEASE AGENT 5.2	FABRICATE FILL BLOCK FOR CASTING RESIN PROCESS 5.3	FABRICATE REINFORCING CORE AND ATTACH METAL HARDWARE 5.4	APPLY SURFACE COATING TO MASTER PATTERN/ MODEL 5.5	SELECT RESINS, MATCHING CATALYST AND COMPONENTS 5.6	WEIGH RESIN AND CATALYST SEPARATELY AND MIX 5.7	POUR CASTING RESIN INTO THE CAVITY 5.8
PRODUCE A WORKING PLASTIC FOUNDRY PATTERN FROM A MASTER MOULD 6.0	CHECK SURFACE FINISH FOR DEFECTS 6.1	SELECT PLASTIC WORKING PATTERN PRODUCTION METHOD 6.2	BUILD SUPPORT FRAME AND COAT WITH RELEASE AGENT 6.3	FABRICATE FILL BLOCK FOR CASTING RESIN PROCESS 6.4	FABRICATE MASTER FILLER BLOCK IN A SHELL CONFIGURATION 6.5	FABRICATE REINFORCING CORE AND ATTACH METAL HARDWARE 6.6	CREATE A WORKING WOODEN PATTERN FOR ALUMINUM BACKUP CASTING 6.7	ROUGHEN CAVITY AREA OF ALUMINUM BACKUP CASTING AND MACHINE 6.8
PRODUCE A MASTER COREBOX FROM A CORESTICK 7.0	SELECT PRODUCTION METHOD 7.1	PRODUCE SUPPORT AND COAT WITH RELEASE AGENT 7.2	FABRICATE LIGHTENER BLOCKS 7.3	FABRICATE BRACES OF REINFORCING MATERIAL 7.4	APPLY RELEASE AGENT 7.5	SELECT MATERIAL 7.6	WEIGH AND MIX MATERIAL 7.7	POUR CASTING RESIN OR GYPSUM CEMENT INTO FRAME OR CONTAINER 7.8
PRODUCE A WORKING INTEGRALLY CAST MATCH PLATE OR COPE AND DRAG SET 8.0	CHECK PRESSURE CASTING FOR SHRINKS, CRACKS AND BLOW HOLES 8.1	MEASURE PRESSURE CASTING DIMENSIONS AND THICKNESS 8.2	STRAIGHTEN PRESSURE CASTING PLATE 8.3	MACHINE BACK FACE OF PRESSURE CASTING 8.4	SCRAPE AND POLISH PRESSURE CASTING 8.5	CHECK PRESSURE CASTING FOR DRAFT/TAPER 8.6	LAY OUT LOCATION OF PIN CENTRES 8.7	BORE HOLES FOR PINS AND BUSHINGS AND/OR MACHINE PERIMETER 8.8
PRODUCE A WORKING SPLIT MOUNTED FOUNDRY PATTERN 9.0	MACHINE PARTING LINES/JOINTS 9.1	ALIGN AND DOWEL COPE AND DRAG OF PATTERNS TOGETHER 9.2	INSTALL FASTENING DEVICES 9.3	MACHINE EXCESS MATERIAL FROM ASSEMBLED SPLIT-PATTERN 9.4	SCRAPE AND POLISH SPLIT-PATTERN 9.5	REPAIR SPLIT-MOUNTED PATTERN 9.6	LAY OUT PIN CENTRES AND PATTERN LOCATIONS 9.7	POSITION PATTERN ON MOULDING PLATE CLAMP AND DRILL 9.8
PRODUCE A METAL COREBOX; CAST TO SIZE OR CAST TO SIZE PARTIALLY MACHINED 10.0	CHECK COREBOX CASTING 10.1	MACHINE BACK FACE AND PARTING LINES/ JOINTS OF COREBOX 10.2	ALIGN AND DOWEL METAL COREBOX HALVES 10.3	MACHINE OPEN ENDS OF COREBOX AND CRITICAL CAVITY AREAS 10.4	FINISH/MACHINE, AND POLISH COREBOX 10.5	ADAPT COREBOX TO FOUNDRY REQUIREMENTS AND TYPE OF CORE MACHINERY 10.6		
PRODUCE A FULLY MACHINED METAL COREBOX 11.0	CHECK COREBOX CASTINGS 11.1	MACHINE BACK FACE, EDGE AND END 11.2	LAY OUT CASTING AND MODEL FOR TOOLING PIN CENTRES 11.3	MACHINE CORE AREAS OF COREBOX CASTING 11.4	FINISH/MACHINE, AND POLISH COREBOX 11.5	ALIGN AND DOWEL METAL COREBOX HALVES 11.6	ADAPT COREBOX TO FOUNDRY PRODUCTION REQUIREMENTS 11.7	
DESIGN CHECKING AND CONSTRUCTION FIXTURES AND GAUGES 12.0	FABRICATE CORE CHECKING DEVICES 12.1	FABRICATE A CORE ASSEMBLY FIXTURE 12.2	FABRICATE CORE SETTING/ CHECKING GAUGES 12.3	PRODUCE COMPONENT CHECKERS 12.4	PRODUCE MACHINERY AIDS 12.5	FABRICATE CONSTRUCTION FIXTURES 12.6		

Ministry of Skills Development
Ontario

FOLLOW COMPANY FIRE PROCEDURES 1.9	LOCK-OUT AND TAG ELECTRICAL AND MECHANICAL EQUIPMENT 1.10	HANDLE TRANSPORT AND STORE HAZARDOUS MATERIAL 1.11	PRACTICE GOOD HOUSEKEEPING 1.12	FOLLOW REPORTING PROCEDURES 1.13	OPERATE LIFTING DEVICES 1.14	RIG AND SECURE LOADS 1.15		
CONVERT DRAWING DIMENSIONS 2.9	CONFER WITH SUPERVISOR 2.10	PRODUCE FULL SCALE LAYOUT(S) OF SECTIONS AND/OR PLANS 2.11	DESIGN AND PRODUCE TEMPLATE(S) 2.12	DETERMINE CONSTRUCTION PROCEDURES 2.13				
RADIUS OUTSIDE CORNERS AND APPLY FILLETS TO INSIDE CORNERS 3.9	PREPARE SURFACES AND CAVITIES 3.10	APPLY SURFACE COATINGS 3.11	ADAPT MASTER PATTERN OR COREBOX FOR MOULDING AND/ OR CORE PROCESS 3.12					
MARK TRIM LINES ON MODEL FOR STAMPING 4.9	PUT TAPER ON MASTER MODEL SURFACES 4.10	MARK OUT ALL TOOLING HOLES AND ADD BUSHINGS 4.11	PREPARE MATCHING JOINTS OF A CORE DRAWBACK 4.12	MARK TOLERANCE ON TRIM LINE OF MODEL 4.13	RADIUS OUTSIDE CORNERS AND APPLY WAX FILLETS TO INSIDE CORNERS 4.14	PREPARE SURFACES OF MASTER MODEL 4.15	APPLY SURFACE COATING OF SANDING SEALER 4.16	MARK HOLES AND SURPLUS MATERIAL 4.17
HAND LAY UP REINFORCING MATERIAL 5.9	APPLY STABILIZED BULK FILLER TO SURFACE COAT 5.10	REMOVE EXCESS MATERIAL FROM JOINT FACE 5.11	EXTRACT MASTER PATTERN/MODEL FROM PLASTIC MOULD 5.12	INSPECT MOULD SURFACE FINISH FOR DEFECTS AND REPAIR 5.13				
APPLY MOULD RELEASE TO MASTER MOULD 6.9	SELECT RESINS, MATCHING CATALYSTS AND COMPONENTS 6.10	WEIGH RESIN AND CATALYSTS SEPARATELY AND MIX 6.11	POUR CASTING RESIN INTO THE CAVITY 6.12	HAND LAY UP REINFORCING MATERIAL TO SURFACE COAT 6.13	REMOVE EXCESS MATERIAL FROM THE JOINT FACE 6.14	EXTRACT MASTER MOULD FROM WORKING PLASTIC PATTERN 6.15	INSPECT SURFACE FINISH FOR DEFECTS AND REPAIR 6.16	
HAND LAY UP EPOXY CLAY/ FIBREGLASS ON GELCOAT-COVERED CORESTICK 7.9	EXTRACT CORESTICK LIGHTENER BLOCKS AND FRAME 7.10	CHECK INTERIOR AND EXTERIOR SURFACE FINISH/ REPAIR 7.11						
INSTALL PINS AND BUSHINGS ON COPE AND DRAG PLATES 8.9	FABRICATE AND INSTALL GATING SYSTEM 8.10	INSTALL FLASK SLIDES ON INTEGRALLY CAST MATCH PLATES 8.11						
ALIGN COPE AND DRAG PLATES 9.9	MOUNT SPLIT-PATTERNS ON MOULDING PLATE(S) 9.10	INSTALL GATING SYSTEMS 9.11	INSTALL PINS AND BUSHINGS 9.12	INSTALL FLASK SLIDES ON SPLIT-MOUNTED MATCH PLATES 9.13				

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